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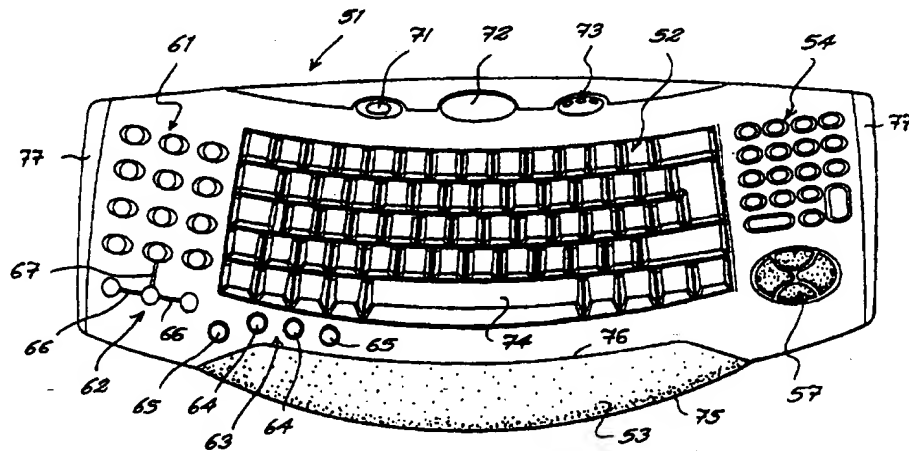
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(54) Title: COMPACT ERGONOMIC COMPUTER KEYBOARD



## (57) Abstract

In a keyboard (51) for a computer, at least a majority of the keys of an alphabetic key region (52) of substantially conventional key layout are laid out along at least one axis of curvature directed towards the user in use of the keyboard. The alphabetic key region (52) is unitary, the keys of the region (52) defining a single key group with no separation of any sub-group of keys of the region (52) from any other sub-group of keys of the region. The keyboard (51) as a whole may itself be curved so that the front edge region of the keyboard (51) comprising a wrist rest (53) projects outwardly towards the user in use of the keyboard. A multiplicity of function keys (61) are provided preferably to the left-hand side of the alphabetic key region (52), to cooperate with mode selection keys (62) so that each function key may fulfill a number of different purposes depending on which mode selection key is also depressed. The keyboard may also comprise a numeric keypad (54) to the right of the alphabetic key region (52), along with cursor control keys (57). In a preferred construction, the keyboard comprises game keys (63).

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COMPACT ERGONOMIC COMPUTER KEYBOARDBackground of the invention

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Field of the invention

This invention relates to computer keyboards. The invention is particularly directed to an improved computer keyboard of inclusive construction and having ergonomic advantages. The invention is especially directed to a keyboard for home use, which is equally applicable both to conventional business purposes and also to the playing of games.

30 Description of the prior art

A multiplicity of computer keyboard constructions are known. However, a widely used computer keyboard structure is one in which the normal typewriter keyboard portion is located towards the left of the keyboard unit, a numeric keypad is located to the right, a multiplicity of control and cursor direction keys is placed between the alphabetic

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portion of the keyboard and the numeric keypad, and a lengthy line of function keys defines an elongate array extending above the alphabetic and keypad regions.

5           An extended keyboard of this kind tends to be relatively intimidating for users, in particular new users. A very large array of generally undifferentiated keys is presented to the user. Furthermore, this conventional construction of keyboard is not ideal for playing computer games, which is often a more important purpose for  
10 a home computer than actual functional use.

These known keyboards are also not necessarily ideal from the ergonomic point of view, and there have been consistent reports of repetitive strain injury arising in users from longterm use of  
15 keyboards of this design.

Keyboards are known in which the QWERTY area is broken into two parts with each individual alphabetic area being curved, together with an overall curvature of the keyboard product, essentially in a  
20 forward or convex direction towards the user. In such arrangements, an integral keyboard casing is provided, with two separate alpha key areas or key sub-groups within it.

#### Brief summary of the invention

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It is an object of the present invention to provide an improved computer keyboard offering ergonomic advantages to all users and providing a concentrated structure which will be particularly advantageous in the home user market, where good appearance is  
30 significant and the playing of games represents a significant purpose of use.

According to the invention in a first aspect, there is provided a keyboard for a computer comprising an alphabetic key region  
35 of substantially conventional key layout, wherein at least a majority

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of the keys of the alphabetic key region are laid out along at least one axis of curvature directed towards the user in use of the keyboard, characterised in that said alphabetic key region is unitary, the keys of said region defining a single key group with no separation of any sub-group of keys of said alphabetic key region from any other sub-group of keys of said alphabetic key region.

The keyboard according to this first aspect of the invention may further comprise a wrist rest along its front edge region directed towards the user in use of the keyboard, characterised in that the keyboard is curved so that the front edge region of the keyboard comprising the wrist rest projects outwardly towards a user in use of the keyboard.

According to the invention in an alternative first aspect, there is provided a keyboard for a computer comprising an alphabetic key region of substantially conventional key layout and a wrist rest along its front edge region directed towards the user in use of the keyboard, characterised in that the keyboard is curved so that the front edge region of the keyboard comprising the wrist rest projects outwardly towards a user in use of the keyboard, and at least a majority of the keys of the alphabetic key region are laid out along at least one axis of curvature substantially corresponding to the curvature of the keyboard as a whole.

The curvature of the front edge region of the keyboard suitably extends about at least one centre of curvature located to the rear of the rear edge region of the keyboard relative to the user position, while the front edge of the wrist rest may be arranged to bulge towards the user by being defined on at least one radius of curvature shorter than a radius of curvature of a casing structure of the keyboard. The front edge of the alphabetic key region may then be defined on at least one radius of curvature shorter than a radius of curvature of a casing structure of the keyboard, said at least one radius of curvature of said front edge of the alphabetic key region

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being preferably shorter than a radius of curvature of a casing structure of the keyboard and longer than a radius of curvature of the front edge of the wrist rest.

5           In a favoured construction, the wrist rest tapers downwardly at the front of the keyboard unit from a location substantially adjacent to the front edge of the alphabetic key region towards the front edge of the wrist rest directed towards the user.

10           According to the invention in a second aspect, there is provided a keyboard for a computer comprising an alphabetic key region of substantially conventional key layout and a multiplicity of function keys located to one side of the alphabetic key region, characterised in  
15           that each of said multiplicity of said function keys is of button configuration. The keyboard of the invention in this second aspect may further comprise a plurality of mode selection keys, means associated with or comprised in the keyboard enabling each of the multiplicity of function keys to fulfill a number of different purposes depending on which mode selection key is also depressed.

20           According to the invention in an alternative second aspect, there is provided a keyboard for a computer comprising an alphabetic key region of substantially conventional key layout and a multiplicity of function keys located to one side of the alphabetic key region,  
25           characterised in that the keyboard further comprises a plurality of mode selection keys, means associated with or comprised in the keyboard enabling each of the multiplicity of function keys to fulfill a number of different purposes depending on which mode selection key is also depressed.

30           The keyboard according to the first aspect of the invention may also comprise a multiplicity of function keys located to one side of the alphabetic key region and a plurality of mode selection keys, means associated with or comprised in the keyboard enabling each of the  
35           multiplicity of function keys to fulfill a number of different purposes

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depending on which mode selection key is also depressed. Said function keys are then suitably laid out on at least one axis of curvature substantially corresponding to the curvature of the alphabetic key region.

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In a favoured arrangement of keyboard according to either aspect of the invention, said mode selection keys are located forward of said function keys towards a user in use of the keyboard, while at least three mode selection keys may be provided. Preferably, said multiplicity of function keys is located to the lefthand side of the alphabetic key region.

The keyboard according to either aspect of the invention may also comprise an array of cursor control or directional keys in which four keys are located within a substantially oval region, the keys being shaped at least peripherally to correspond to said oval region. Said array of cursor control or directional keys is suitably located to the righthand side of the alphabetic key region.

According to a third aspect of the invention, there is provided a keyboard for a computer comprising an alphabetic key region, characterised in that the keyboard further comprises at least one plurality of game keys. The keyboard according to either the first or second aspects of the invention may likewise similarly comprise at least one plurality of game keys.

In an especially favoured construction, said at least one plurality of game keys is located in the region between the front edge of the alphabetic key region and the front edge region of the keyboard directed towards the user in use of the keyboard. Said at least one plurality of game keys may be located towards the lefthand end of said region.

Alternatively, said at least one plurality of game keys may be located centrally and substantially symmetrically relative to the front

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to rear axis of the keyboard. In another variant, said at least one plurality of game keys may be located on the underside of the keyboard.

In any variant of the invention in its third aspect, at least  
5 two pluralities of game keys may be provided. Preferably, the or each plurality of game keys comprises four game keys. The two innermost keys may be arranged to project upwardly to a slightly greater extent than the outermost keys of said four game keys, while each game key may also be provided with a touch sensitive insignia or indicia.

10

The keyboard according to the invention may comprise a pointing device integrated into a casing structure of the keyboard. The pointing device may be located to one side of the alphabetic key region and may be a touchpad. Alternatively, the pointing device is a  
15 stick-pointer or a gyro pointer. In a further variant, a gyro pointer device may be associatable with the keyboard.

Finally, the invention also encompasses a keyboard for a computer having an alphabetic key region of substantially conventional  
20 key layout, a pointing device and at least one associated control key, an array of cursor control or directional keys, and a multiplicity of keys for effecting functional operations in use of the keyboard, wherein:

- 25 (a) the keyboard comprises a wrist rest along its front edge region directed towards the user in use of the keyboard,
- (b) the keyboard is curved so that the front edge region of the keyboard comprising the wrist rest projects outwardly towards a user in use of the keyboard,
- 30 (c) the keys of at least the alphabetic key region are also laid out along axes of curvature substantially corresponding to the curvature of the keyboard as a whole,
- (d) the pointing device and its associated control key or keys are incorporated in the keyboard,
- 35 (e) the pointing device and its associated control key or keys and



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the array of cursor control or directional keys are located to one side of the alphabetic key region, and

(f) the multiplicity of function keys are located to the other side of the alphabetic key region.

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A significant advantage of the keyboard resides in its improved ergonomic performance. In addition to its being easier to use and more natural in use, the keyboard of the invention is also visually pleasing to look at, so that it may represent an acceptable  
10 piece of furniture in a domestic concept. The visual aspect of the keyboard of the invention is also less stressful for the user, while the provision of the integrated wrist rest also contributes to the visual impact, as well as this integrated wrist rest feature engendering ergonomic advantages. In particular, the appearance and  
15 arrangement of the keyboard is less intimidating for users coming to computers for the first time, with a clear distinction being made and emphasised between the alphabetic or QWERTY area and the other regions of the keyboard.

20 A further advantage is represented by the provision of an integrated games facility. Effectively, the invention provides two keyboards or input devices within a single unit, in the form of a keyboard suitable for normal computer operations or functions, as well as an input device suitable for games playing, in other words, a games  
25 console. There is a commensurate economic gain by this dual functionality of the invention.

The distinctive layout and relocation of the function keys further enhances user productivity when working on a computer system  
30 equipped with a keyboard of the invention.

Finally, the pleasing appearance of the invention not only enables it to fit in, as it were on the domestic scene, but also to match the high quality look and feel of modern quality computer  
35 systems, especially when moulded in distinctive colourations.

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Brief description of the drawings

The invention will now be described with reference to the accompanying drawings, in which:

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Figure 1 is a plan view of a first embodiment of keyboard according to the invention,

10 1, Figure 2 is a front elevational view of the keyboard of Figure 1,

Figure 3 is a side view from the lefthand side of the keyboard of Figure 1,

15 Figure 4 is a diagrammatic pictorial representation of variant in the keyboard according to the invention as shown in Figures 1 to 3, showing the positions occupied by a user's hands during use of the keyboard,

20 Figure 5 is a plan view of a second embodiment of keyboard according to the invention,

Figure 6 is a front elevational view of the keyboard of Figure 5, and

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Figure 7 is a side view from the lefthand side of the keyboard of Figure 5.

30 As shown in Figures 1, 2 and 3, the computer keyboard 1 according to the invention in a first embodiment has a plastics body portion in which there is provided an alphabetic keyboard region 2, laid out in the conventional "QWERTY" manner. As shown in Figure 1, the "QWERTY" key layout is a European (ISO) arrangement, but this European key layout may be substituted by an American (ANSI) style key  
35 layout, without departing from the scope of the invention. In a U.S.

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or North American key layout, the differences from the European arrangement reside principally towards the righthand end of the key cap region and also in part at the extreme left hand end of the alphabetic region.

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According to the present invention, the keyboard casing 1 is shaped so as to provide a curved front edge, which projects centrally towards the user in use of the keyboard, i.e. convexly from the keyboard towards the user. This front edge region is defined by a  
10 wrist rest 3, subsequently further described. In order to facilitate a concentrated and ergonomic construction, the diversity of facilities provided in a longitudinal manner on a conventional keyboard are provided in a different configuration. The layout of the keyboard of the invention is fully compatible with current software system  
15 requirements, including "Windows 1995". The "QWERTY" core 2 comprises full travel key switches, while all other key switches, including function keys, mode keys and gaming keys, are short travel key switches, or buttons, the game and cursor keys having however longer travel than the function keys.

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To the righthand side of the alphabetic portion 2, there is provided a touch pad 4 and associated button 5, suitably of the "Glidepoint" type. Forward of the touch pad 4, in the direction towards the user, there are provided left and right "Glidepoint"  
25 control keys 6, each of which is arranged to have a distinct movement in the direction of travel, viz. left or right, to give a mouse-like feel. Alternative pointing arrangements may however also be provided, as discussed further subsequently. Cursor control keys 7 for the four directions of movement are arranged in a single array, forward again of  
30 the "Glidepoint" control keys 6. To the left of the alphabetic portion 2, the function keys of a conventional keyboard are substituted by an array of twelve short travel keys 11, the functional activation of which is controlled by the use of three mode keys 12 located forward of the array 11, so that the array of twelve short travel keys provides  
35 a total of thirty-six possible functions. Each function key 11 thus

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has three uses or modes, each mode being accessed by depression of one of the three mode buttons 12 located forward of the function key array 11. The mode buttons 12 are suitably colour-coded short travel switches, each also being provided with a light emitting diode to light up when the keycap in question is depressed. The labels for the function keys, as embossed or otherwise displayed on the surface of the keyboard casing, are also colour coded, so as to match the colour coding of the mode selection keys. Thus for example, in the event of three mode selection keys being provided, one without colouration, one red and the third blue, each function key may be provided with three labels, for example one label without colouration on the key itself, and two further labels above the key, one label being in red and the other label being in blue. The term without colouration is intended to mean no distinctive colouration. The marking on the key in this case may be for example black on a white or cream key, or white on a black key.

It is a particular feature of the invention that button-type keys, rather than alphabetic style large keycaps, are applied to the function keys, thereby resulting in a compact and easy to operation function key arrangement.

Turning now to the second embodiment of the invention shown in Figures 5, 6 and 7, for which reference numerals commencing from 51 are in question, the general arrangement is substantially similar to that of Figures 1 to 3, i.e. the first embodiment. Thus the keyboard 51 has an alphabetic region 52 and a forwardly convex front edge, curved to project outwardly centrally towards the user in use of the keyboard, to define a wrist rest 53. A four key cursor control array 57 is again provided to the righthand side of the alphabetic portion 52, in similar manner to the first embodiment. As compared with the cursor keys of the first embodiment, those of the arrangement of Figures 5, 6 and 7 are set into a depressed, dished or indented area or region, to provide a sculpted key arrangement. In this embodiment, the top surfaces of the keys are substantially flat or planar, or may be

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slightly dished, as compared with the domed arrangement of the first embodiment. Location of the cursor keys is facilitated by their placement within a recessed surface area or region of the keyboard casing. The keys of the cursor key array in this embodiment may be  
5 arranged to depress more or less uniformly, namely in a non-tilt manner as such, although those cursor keys of larger surface area may experience a degree of tilting to some extent depending on the manner in which they are depressed. In other words, if the key is depressed by contact near its periphery or edge, a quasi-tilting effect may be  
10 produced. However, in place of the touchpad, button and "glide point" control keys of the first embodiment, these together defining a pointing arrangement or device, the second embodiment of Figures 5 through 7 is provided with a numeric key pad 54 in this region, the numeric key pad comprising eighteen keys in a conventional numeric key  
15 layout.

Alternative pointing arrangements may include use of a "stick-pointer" device located on the keyboard, typically within the QWERTY region, activated by finger contact with a small pad located at  
20 the upper end of an upstanding pillar or pin of slender dimensions, rubbing action of the finger on the stick-pointer activating cursor movement over the screen. A further possible pointer variant is provided by use of a gyro pointer device which reports its three-dimensional location when held in space, in addition to being  
25 usable in similar manner to a mouse on a flat surface. Corded or cordless gyro pointer devices may be used in conjunction with the invention, while in a still further variant, a gyro pointer device may be incorporated in the keyboard itself and cursor control achieved by moving the entire keyboard with integral gyro pointer around in space.

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The arrangement of Figures 5, 6 and 7 is however similar to that of Figures 1, 2 and 3 to the lefthand side of the alphabetic key array 52, an array 61 of function keys again being provided for selective modal use in dependence on activation of three modal keys 62  
35 located forward of the function key array 61. A further difference

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from the first embodiment is provided by the incorporation, in the keyboard moulding, of shallow grooves 66 linking the mode keys 62 in substantially linear manner, with a further groove 67 linking the centre mode key to the central function key in the forwardmost run of function keys, towards the user. These grooving features 66 and 67 are typically 0.5 mm in transverse dimension and provide an effective and useful touch locational feature in use of the keyboard.

The unit of the invention in both embodiments is particularly suitable for home use, in which games will be at least as important a purpose as more functional operations. To this end, the unit 51 of Figures 5 to 7 inclusive also comprises a further four game playing keys 64, 65, again in the form of short travel keys, these being located between the front edge of the alphabetic portion 52 of the keyboard and the wrist rest 53, towards the lefthand side, as shown in the drawing of Figure 5. This group 63 of four game keys 64, 65 has the two centre keys 64 arranged to project upwardly somewhat further than the two outermost keys 65, for convenience of use. The location shown in Figure 5 is not however necessarily the only position for these keys and they may also be located centrally, in front of the space bar 24, 74 and between the space bar 24, 74 and the wrist rest 3, 53, preferably in a symmetrical manner about the front to rear axis of the unit 1, 51. Such a location for the games keys is shown in the pictorial representation of Figure 4, where a games key group 13 comprising keys 14 and 15 is located centrally of the keyboard, between the spacebar 24 and the wrist rest 3, in an embodiment otherwise corresponding generally to that of Figures 1 to 3.

As an alternative to the central location of the games keys, or their location at the lefthand end of the keyboard, two sets of games keys may be provided, one towards the righthand side of the keyboard and the other towards the lefthand side, so that two players may play a game. Thus in the keyboard of the invention, games keys are provided in combination with other keyboard features to provide a keyboard having dedicated games keys. In addition to the central or

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end locations discussed above, these keys may also be located on the underside of the keyboard, in similar manner to certain known versions of games consoles. In such an arrangement, the keyboard may be held in the lap and the games keys activated by placing the fingers over the edges of the keyboard to engage the games keys. A favourite position for such games keys would be towards the sides of the keyboard, along the rear edge and beneath that rear edge. A games key arrangement of this kind may provide for two-handed game playing, with a number of keys activated by the left hand towards the lefthand end of the keyboard, on the rear underside, with similar keys for the right hand at the righthand side of the keyboard.

The games keys may be programmable with or without a screen display. In the absence of a screen display for games key programming, the keyboard may be put into a program mode, at which time the relevant LED enters a flashing mode. Programming may then be effected by depressing one or more keys in the QWERTY region, following by depression of the relevant games key. The current state of such a programming operation may be indicated by varying the rate of flashing of the relevant LED on the keyboard. Thus for example, an initial flashing rate may be set at a quarter second periodicity, moving then to flashing every half-second to indicate that an alpha key should be depressed, with reversion to the slower rate of flashing when games key programming has been correctly completed.

All key switches are responsive, so that the user is aware of a tactile feel when the switch is activated. This is achieved by giving the key a slight resistance to movement when pressed, following which it then moves very freely to the bottom of its travel. During return of the switch to its stable position, it puts a slight but noticeable pressure on the finger, until travel of the key has been completed. The cursor keys 7, 57 consist of four separate actuators located in an oval configuration on the righthand side of the keyboard 51. The arrangement may be such that the direction of the keys 7, 57 is not only indicated on the keys but is also perceived by the key

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having a distinct movement in the direction activated, so that the up-key pivots in a direction indicative of up cursor movement, and so on. The feel of each of these switches may thus be adapted to be similar to that of a mouse key, in other words a pivoting type movement.

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The games keys 63 to the lefthand side of the keyboard as shown in Figures 5 to 7 of the drawings may be structured to have the same feel as the cursor keys 57. The games keys 63 in this embodiment are laid out along a non-linear path so as to match the natural  
10 position of the hand. As will be apparent from the plan view of Figure 5, the curved arrangement of the games key group 63 is in this instance broadly concave towards the user, namely the keys 64, 65 are laid out along a generally non-linear path, corresponding to the general locations of the fingertips in extended radial dispositions of  
15 the fingers. A generally non-linear layout may also be applied in the arrangement shown in Figure 4, instead of the generally linear or convexly curved sequence of the games keys apparent from this drawing. In further amplification of the general layout of the games keys, in the arrangement of Figures 5, 6 and 7, the three righthand  
20 keys of the games key group generally follow the curvature of the front edge of the keyboard, in generally forwardly convex manner, i.e. curved towards the user, while the lefthandmost key is brought somewhat forward of the line followed by the three righthand keys. The general arrangement is therefore such that the games keys will more or less  
25 underlie an extended hand when positioned in that region.

The function keys 11, 61 are low profile keys of the minimum travel mechanical type.

30 Further features provided to the rear of the alphabetic portion are an escape key 21, 71 a keyboard logo 22, 72 and three light emitting diodes 23, 73 indicating the locked condition for numeric operation, capitals or scroll. Other similar features may also be incorporated. The feature 22, 72, which may represent a keyboard  
35 logo, may also be substituted by an on/off switch, or other operating



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feature of the keyboard. As shown in the drawings, for both embodiments and for the variant of Figure 4, the keyboard also has a degree of outward convexity in this rearward region accommodating the features 21, 71; 22, 72 and 23, 73, the curvature being however substantially shallower, i.e. of greater radius, than that of the front region. Other rear profiles of the keyboard may however alternatively be provided within the scope of the invention.

In order to provide the ergonomically advantageous forward or convex curvature of the keyboard 1, 51 towards the user, the entire alphabetic key area 2, 52, the short travel or function keys 11, 61 to the left of the alphabetic region 2, 52, and the touch pad 14 or numeric pad 54 and control keys 6, 7, 57 to the right of the region 2, 52 are all laid out symmetrically about at least one axis of curvature so that the keyboard is forwardly or convexly curved over at least a substantial longitudinal region of the keyboard between the lefthand side of the keyboard casing and the righthand side, the axis being located substantially centrally of the keyboard 1, 51 in its longitudinal direction and having a centre located outward of the unit to its rear. The curve is thus relatively gentle and is drawn about a substantially large radial dimension. The keys of the alphabetic panel 2, 52 in particular accordingly differ from those of a conventional keyboard, in that they are laid out on a gentle curve which bulges towards the user in a generally convex forward manner. The front edge of the alphabetic region 2, 52 of the keyboard 1, 51 directed towards the user may also bulge slightly more at its centre, in the space bar region 24, 74, by virtue its being defined along a slightly shorter radius of curvature, located however on the same front to rear axis as that of the casing 1, 51 as a whole. To accommodate this further degree of forward or convex curvature, the keys along the front edge, including the space bar 24, 74, are suitably profiled.

Preferably, the general curvature of the keyboard is drawn at the same radius throughout the axial length of the keyboard, i.e. from left to right, but the radius of curvature may also be varied at

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different locations along this axial extent. Portions of this axial length may optionally have no curvature, i.e. be straight, or have a degree of reverse curvature provided that at least a major region of the axial extent is forwardly curved.

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As shown in the plan views of Figures 1 and 5, the wrist rest 3, 53 has a radius of curvature at its rear edge 26, 76 which matches that of the front edge space bar region 24, 74 of the alphabetic region 2, 52. The wrist rest 3, 53 is however deeper at its centre than it is towards its left and right sides, so that the front edge 25, 75 of the wrist rest region 3, 53 which projects towards the user is therefore defined along a shorter radius again than that of the front edge 24, 74 of the alphabetic region 3, 53. As shown in the side elevation views of Figures 3 and 7, the wrist rest 3, 53 also slopes down uniformly towards the front edge 25, 75, thereby providing an advantageous profile for user wrist support in use of the keyboard 1, 51.

The forward or convex curvature or bulge of the keyboard towards the user is thus effected, in the embodiments of the invention, about at least three axes of a curvature, the first being a general axis of forward curvature applicable to the keyboard casing as a whole and in particular to the major portion of the alphabetic key pad region 2, 52. This radius of curvature applies to the rearmost four key rows of the region 2, 52, to the rear edge of the front or spacebar row of keys, and also to the left to right alignment of the associated function keys, 11, 61, the pointing 4 or numeric key pad 54 region, and the cursor control arrangements 7, 57 at the righthand side of the keyboard. All of these features follow this first radius of curvature. A second or shorter radius of curvature applies to the front edge boundary of the forwardmost row of keys of region 2, 52, namely the boundary or front edge defined by the side of the region 2, 52 directed towards the user in operation of the keyboard. This second shorter radius of curvature means that the front edge of the alphabetic region 2, 52 projects to a greater extent towards the user,

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namely that it has more of a bulge or a greater degree of convexity than the remainder or rearward portion of the region 2, 52. The rear edge 26, 76 of the wrist rest region 3, 53 matches this front edge curvature of the alphabetic region 2, 52, but a third, still shorter  
5 radius of curvature defines the front edge 25, 75 of the wrist rest region 3, 53. This third radius of curvature is thus of shorter than either the second radius of curvature defining the front edge boundary of the alphabetic region 2, 52 or the general radius of curvature defining the overall forward convexity or bulge of the alphabetic  
10 region. Thus the front edge 25, 75 of the wrist rest projects or bulges still further forwardly towards the user in use of the keyboard than the remaining rearward structure of the keyboard, and in particular this forward bulge or additional convexity is greater than the forward bulge or convexity of the front edge of the alphabetic  
15 region. Each of these individual curvatures may itself be drawn at a succession of varying radii along its axial length.

It is a particular feature of the invention that this forwardly curved alphabetic area comprises a single unitary entity,  
20 with no discontinuation at any stage from left to right. This is an important distinction between the arrangement of the invention and the two-part alphabetic area of known so-called "broken" keyboards, where the separation of some of the alpha keys as a sub-group from the remainder of the alpha keys which form a second sub-group requires new  
25 training for users and a different approach by users, necessitating each hand to be confined to certain alpha keys only, as compared with a unitary QWERTY region, where either hand can operate towards either side of the keyboard, as necessary. The integral or unitary QWERTY area of the present invention avoids the inevitable loss of  
30 productivity occasioned by splitting the alphabetic area into separate sub-regions.

While the curvature of the alphabetic region of the keyboard of the present invention should be generally forward or convex towards  
35 the user, it is not essential for this forward curvature to be

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necessarily maintained over the entire longitudinal extent of the keyboard. Arrangements are also possible in which for example a portion of the keyboard may comprise no substantial curvature, in other words be largely linear or straight. Such an arrangement may prevail, for example towards the outer ends of the keyboard, at the left and righthand sides of the alpha region. Alternatively, a slight reverse curvature may be provided in these regions. Furthermore, the radius of curvature may not necessarily be the same at all locations along the longitudinal extent of the alphabetic region, and different radii of curvature may be provided at different sections along the length of the keyboard.

On the righthand side, in the embodiment of Figures 1 to 3 and the variant of Figure 4, the touch pad 4 and its associated actuation button 5 and "Glidepoint" control keys 6 are readily accessible by the user, to move around the screen, while the directional cursor control keys 7 beneath the touch pad 4 are laid out within the curved oval peripheral region already mentioned and are domed and shaped so as to provide an arrangement similar to that usual in games computers. The touch pad surround is also provided with a finish to clearly identify the functionality of this portion of the unit to the user. A similar ready accessibility to the numeric key pad 54 and the cursor keys 57 is provided in the second embodiment of Figures 5 through 7.

The gaming keys 13, 63 of the keyboard 1, 51 of the invention are programmable by the user, for example, with the aid of a screen display control panel, using software suitably provided with the keyboard, or without screen display. Interconnection of the keyboard 1, 51 to a computer may be effected by cable connection or by an infrared ray transmitter attached to a module slot at the back of the keyboard. A preferred cable connection (not shown) may be permanently fixed to the keyboard 1, 51 and may be provided with two connectors at the end attachable to the computer chassis. One connector may provide for keyboard data interchange, while the other may provide for the touch pad or Glidepoint interface. The unit 1, 51 may also

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incorporate a touch sensitive strip to assist in use of the function keys, located either above the function keys or forward of them on the user's side, or alternatively in the keycaps themselves. In addition to setting the gaming keys, software provided with the unit enables  
5 keyboard set-up in general and alterations to settings in a simple and straightforward manner, using a screen displayable control panel.

The games keys may also be provided with insignia or shapes, for example triangle, square, circle and cross, in accordance with  
10 known conventions. These insignia may be indented into or embossed on the keys, to facilitate touch use of the gaming keys.

The three level function key arrangement provides for selection of three alternative function arrays in key group 11, 61,  
15 depending on the particular mode key 12, 62 depressed. Use of a first selection key provides for the first level of the function keys to apply in operation, while the second selection key changes the functions of the keys over to for example less used functions, and so on for the third key. Thus the twelve function keys are freely  
20 selectable under any one of three modes. Selection is effected by suitable software associated with the keyboard, or optionally comprised therein as "firmware". A first mode may allow access to the normal "F" function features which are available for the application in current use. A second mode may allow access to keys normally resident  
25 in other sections of a standard keyboard, such as "delete", "end", "page up" and "page down". In this mode, extended features are provided without requiring the use of an extended keyboard of physically large and space-consuming dimensions. A third function mode, selected by the third mode key, may allow access to programmable  
30 keys allowing standard computer operations to be carried out in a more direct and speedy manner. In this third mode, access to "quick print", "quick save" or "quick Internet access" may for example be provided. In a further option, this third mode may also be freely programmable by loading a software driver originating from a third  
35 party supplier. It is an important feature of the present invention

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that the operation of the function keys is freely selectable by the user by appropriate activation of the relevant mode key.

The number of modes is not limited to three, and may be  
5 extended to six or more possible modes by the use of extra keys, or by  
other arrangements such as for example key combinations. In any mode,  
software is preferably associated with the keyboard to provide access  
to a graphical screen display showing the function of each key at all  
times. This graphical display is available to the user at all times  
10 by a single key stroke from the keyboard. In a further variant of the  
invention, the numeric keys may be provided as a function of the  
function keys, so that one of the functional options or modes is that  
the keys of the function array operate as a numeric pad, for example  
when an NUM or mode key is depressed.

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The advantages achieved by the invention include an integrated  
keyboard especially suited to home use. The keyboard may in fact be  
used on the user's lap and not necessarily on a formal support surface  
of any kind. This integral arrangement may be achieved in one  
20 embodiment by having a screen pointing device in the form of a touch  
pad incorporated into the keyboard. In a second embodiment, the  
pointing device may be substituted by a numeric key pad of compact  
dimensions. Further features enabling the achievement of a  
consolidated structure are the use of the multimode short travel keys  
25 or buttons to the left of the keyboard to achieve the various  
functional requirements of the system in place of the usual row of  
function keys above the alphabetic panel.

Ergonomic advantages are achieved in the keyboard of the  
30 invention by its curved layout which, while simple and effective, in  
that it maintains the conventional alphabetic keyboard layout with  
which users are familiar, nonetheless enables the user to access keys  
in a more comfortable and convenient manner. User wrist support is  
particularly facilitated by the forward extension of the keyboard  
35 defining the wrist rest region.

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Figure 4 is a pictorial representation of a variant of the first embodiment of the keyboard according to the invention showing a user's left hand and right hand 31, 32 in ghost outline. The left hand 31 is poised over the keyboard, while the right hand 32 is being  
5 moved towards the keyboard, to bring the wrist into the rest position in which it cooperates with the wrist rest 3 of the keyboard 1. The convenience of use of the invention will be immediately apparent from the representation of Figure 4, as also will be the facility for wrist support in use of the keyboard, thereby providing great comfort as  
10 compared with many prior arrangements. The pictorial view of Figure 4 also shows the game key group 13 in the alternative position substantially centrally of the keyboard, as compared with the location shown in Figure 5, where it is located towards the lefthand side of the alphabetic region 52 and forward of this region, between the alphabetic  
15 panel 52 and the user. This alternative location may be found desirable in certain constructions of the keyboard of the invention.

Further ergonomic advantages may be achieved by the base or underside of the casing of the unit being profiled so as to prevent the  
20 keyboard from slipping when the keyboard is placed on a user's lap, by creating friction between the underside of the casing and the user's lap. For use on a flat surface, height adjustable legs may also be provided on the undersurface of the keyboard casing. The upper  
25 surface of the casing suitably has a hard textured surface, with the areas around the short travel or function keys being shaped so as to guide the user's fingers onto each function keycap. The wrist rest section of the housing is preferably provided with a textured surface different in colouration from the remainder of the keyboard casing. The wrist rest region is thereby distinguished from the remainder of  
30 the keyboard both by feel or touch and by visual appearance.

At each lateral side or longitudinal end of the keyboard, a detachable rubber stop 27, 77 may be inserted into the casing 1, 51 to provide the keyboard 1, 51 with a smooth and attractive appearance, in  
35 the absence of side modules, not shown in the drawing, which are

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optionally connectible to the keyboard. These rubber stops also protect the mechanical/electrical interface between the keyboard unit itself and any associated side modules from damage, when the modules are not in position. Alternatively, the keyboard of the invention may  
5 be a single moulded module, complete and integral in itself, without connectibility to side modules, in which construction, the longitudinal ends of the keyboard casing are themselves moulded and the provision of detachable rubber stops is not required.

10 In the home scene, use for games of a computer with which the keyboard is associated is also facilitated by the directional or cursor control key array being laid out in the manner of a games machine at the righthand side of the keyboard, while other games functions are facilitated by the group of short travel keys to the front of the  
15 alphabetic region which again match known arrangements in purpose-built games machines.—The keyboard of the invention further enhances the usefulness of home personal computers by providing a full feature keyboard, compatible in all respects with the wide range of professional and recreational applications on the market. Further  
20 advantages of the keyboard of the invention are a construction which is suitably sufficiently robust to withstand the harsh family environment, while yet being elegant and attractive in style so as to match modern home furniture.

25 In the keyboard of the invention, the QWERTY alphabetic area is emphasised, thereby engendering the easy to use aspect of the invention. The curved central presentation of the QWERTY layout appeals to both adults and children. The incorporation in the keyboard of the invention of games keys familiar to many children from  
30 specific games consoles is a further advantage, in that an arrangement of games keys with which potential users are familiar is thereby incorporated in a computer keyboard as such. Increased productivity is achieved by the separation out of the function keys in a special area of the keyboard. The function keys may for example be applied to  
35 specific tasks, on a programmable basis, by virtue of which a print



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instruction for example may be programmed into the system and initiated by a single key stroke, rather than initiating printing by working through a series of menu instructions. One of the available modes may apply for example to the application of an Internet driver. For such specialised programmable use, an overlay may be provided to surround the function keys, on which a user may indicate his own individual functions for the various function keys.

In addition to LED displays indicating which mode is currently applicable, LCD messages may also be displayed to indicate that a particular mode key driver is loaded. Such displays may be associated with each function key, instead of, or in addition to, prescribed function labels being moulded into the casing or printed onto it.

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CLAIMS

1. A keyboard for a computer comprising an alphabetic key region of substantially conventional key layout, wherein at least a majority  
5 of the keys of the alphabetic key region are laid out along at least one axis of curvature directed towards the user in use of the keyboard, characterised in that said alphabetic key region is unitary, the keys of said region defining a single key group with no separation of any sub-group of keys of said alphabetic key region from any other  
10 sub-group of keys of said alphabetic key region.
2. A keyboard according to Claim 1, further comprising a wrist rest along its front edge region directed towards the user in use of the keyboard, characterised in that the keyboard is curved so that the  
15 front edge region of the keyboard comprising the wrist rest projects outwardly towards a user in use of the keyboard.
3. A keyboard for a computer comprising an alphabetic key region of substantially conventional key layout and a wrist rest along its  
20 front edge region directed towards the user in use of the keyboard, characterised in that the keyboard is curved so that the front edge region of the keyboard comprising the wrist rest projects outwardly towards a user in use of the keyboard, and at least a majority of the keys of the alphabetic key region are laid out along at least one axis  
25 of curvature substantially corresponding to the curvature of the keyboard as a whole.
4. A keyboard according to Claim 2 or Claim 3, wherein the curvature of the front edge region of the keyboard extends about at  
30 least one centre of curvature located to the rear of the rear edge region of the keyboard relative to the user position.
5. A keyboard according to any of Claims 2 to 4, wherein the front edge of the wrist rest is arranged to bulge towards the user by  
35 being defined on at least one radius of curvature shorter than a radius of curvature of a casing structure of the keyboard.

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6. A keyboard according to any of Claims 2 to 5, wherein the front edge of the alphabetic key region is defined on at least one radius of curvature shorter than a radius of curvature of a casing structure of the keyboard.

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7. A keyboard according to Claim 6, wherein said at least one radius of curvature of said front edge of the alphabetic key region is shorter than a radius of curvature of a casing structure of the keyboard and longer than a radius of curvature of the front edge of the wrist rest.

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8. A keyboard according to any of Claims 2 to 7, wherein the wrist rest tapers downwardly at the front of the keyboard unit from a location substantially adjacent to the front edge of the alphabetic key region towards the front edge of the wrist rest directed towards the user.

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9. A keyboard for a computer comprising an alphabetic key region of substantially conventional key layout and a multiplicity of function keys located to one side of the alphabetic key region, characterised in that each of said multiplicity of said function keys is of button configuration.

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10. A keyboard according to Claim 9, further comprising a plurality of mode selection keys, means associated with or comprised in the keyboard enabling each of the multiplicity of function keys to fulfill a number of different purposes depending on which mode selection key is also depressed.

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11. A keyboard for a computer comprising an alphabetic key region of substantially conventional key layout and a multiplicity of function keys located to one side of the alphabetic key region, characterised in that the keyboard further comprises a plurality of mode selection keys, means associated with or comprised in the keyboard enabling each of the multiplicity of function keys to fulfill a number of different purposes depending on which mode selection key is also depressed.

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12. A keyboard according to any of Claims 1 to 8, comprising a multiplicity of function keys located to one side of the alphabetic key region and a plurality of mode selection keys, means associated with or comprised in the keyboard enabling each of the multiplicity of function  
5 keys to fulfill a number of different purposes depending on which mode selection key is also depressed.

13. A keyboard according to Claim 12, wherein said function keys are laid out on at least one axis of curvature substantially  
10 corresponding to the curvature of the alphabetic key region.

14. A keyboard according to any of Claims 10 to 13, wherein said mode selection keys are located forward of said function keys towards a user in use of the keyboard.

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15. A keyboard according to any of Claims 10 to 14, comprising at least three mode selection keys.

16. A keyboard according to any of Claims 9 to 15, wherein said  
20 multiplicity of function keys is located to the lefthand side of the alphabetic key region.

17. A keyboard according to any preceding claim, comprising an array of cursor control or directional keys in which four keys are  
25 located within a substantially oval region, the keys being shaped at least peripherally to correspond to said oval region.

18. A keyboard according to Claim 17, wherein said array of cursor control or directional keys is located to the righthand side of the  
30 alphabetic key region.

19. A keyboard for a computer comprising an alphabetic key region, characterised in that the keyboard further comprises at least one plurality of game keys.

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20. A keyboard according to any of Claims 1 to 17, comprising at least one plurality of game keys.

21. A keyboard according to Claim 19 or Claim 20, wherein said at least one plurality of game keys is located in the region between the front edge of the alphabetic key region and the front edge region of the keyboard directed towards the user in use of the keyboard.

22. A keyboard according to Claim 21, wherein said at least one plurality of game keys is located towards the lefthand end of said region.

23. A keyboard according to Claim 21, wherein said at least one plurality of game keys is located centrally and substantially symmetrically relative to the front to rear axis of the keyboard.

24. A keyboard according to Claim 19 or Claim 20, wherein said at least one plurality of game keys is located on the underside of the keyboard.

25. A keyboard according to any of Claims 19 to 24, comprising at least two pluralities of game keys.

26. A keyboard according to any of Claims 19 to 25, wherein said at least one plurality of game keys comprises four game keys.

27. A keyboard according to Claim 26, wherein the two innermost keys are arranged to project upwardly to a slightly greater extent than the outermost keys of said four game keys.

28. A keyboard according to any of Claims 19 to 27, wherein each game key is provided with a touch sensitive insignia or indicia.

29. A keyboard according to any preceding claim, comprising a pointing device integrated into a casing structure of the keyboard.

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30. A keyboard according to Claim 29, wherein the pointing device is located to one side of the alphabetic key region.
31. A keyboard according to Claim 29 or Claim 30, wherein the pointing device is a touchpad.
32. A keyboard according to Claim 29, wherein the pointing device is a stick-pointer.
33. A keyboard according to Claim 29, wherein the pointing device is a gyro pointer.
34. A keyboard according to any of Claims 1 to 28, wherein a gyro pointer device is associatable with the keyboard.
35. A keyboard for a computer having an alphabetic key region of substantially conventional key layout, a pointing device and at least one associated control key, an array of cursor control or directional keys, and a multiplicity of keys for effecting functional operations in use of the keyboard, wherein:
- (a) the keyboard comprises a wrist rest along its front edge region directed towards the user in use of the keyboard,
  - (b) the keyboard is curved so that the front edge region of the keyboard comprising the wrist rest projects outwardly towards a user in use of the keyboard,
  - (c) the keys of at least the alphabetic key region are also laid out along axes of curvature substantially corresponding to the curvature of the keyboard as a whole,
  - (d) the pointing device and its associated control key or keys are incorporated in the keyboard,
  - (e) the pointing device and its associated control key or keys and the array of cursor control or directional keys are located to one side of the alphabetic key region, and
  - (f) the multiplicity of function keys are located to the other side of the alphabetic key region.

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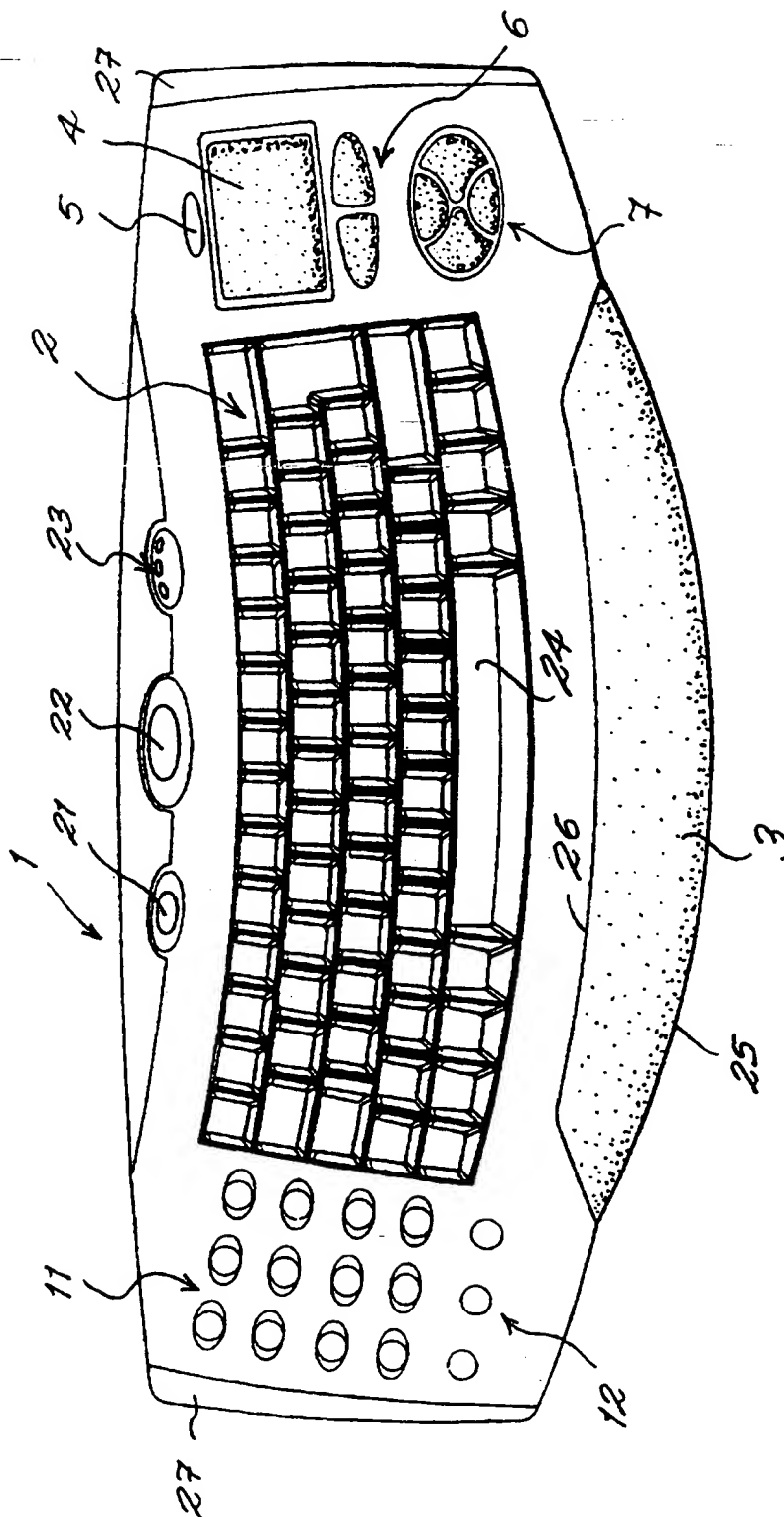
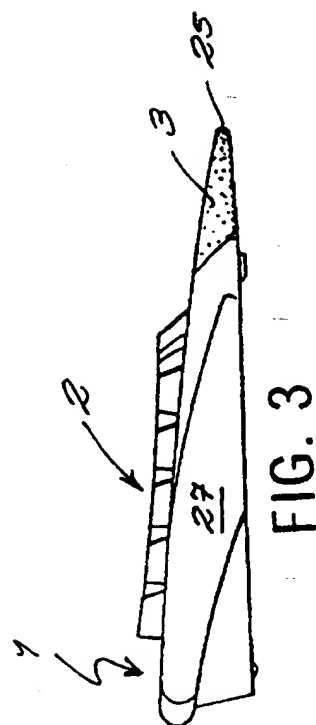
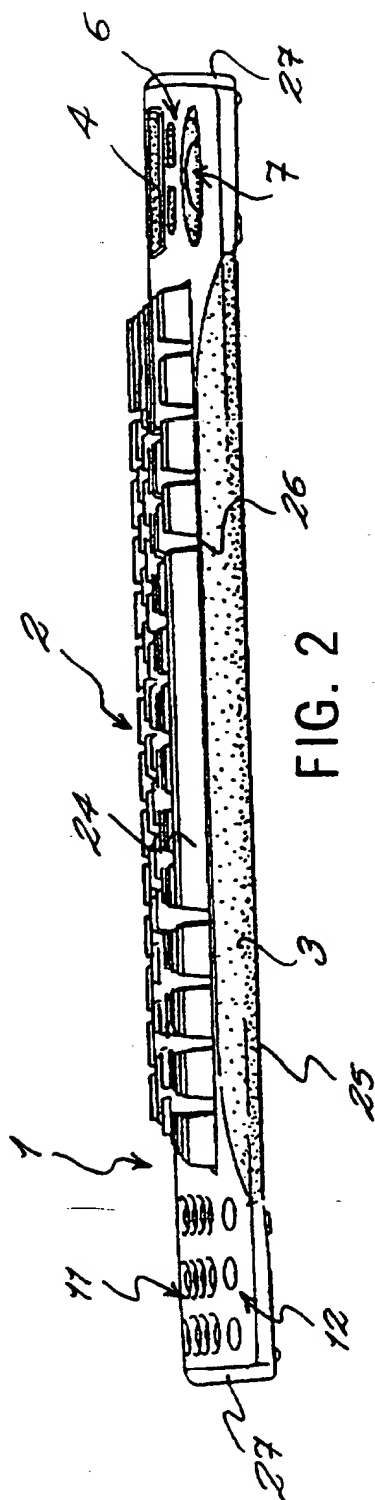


FIG. 1

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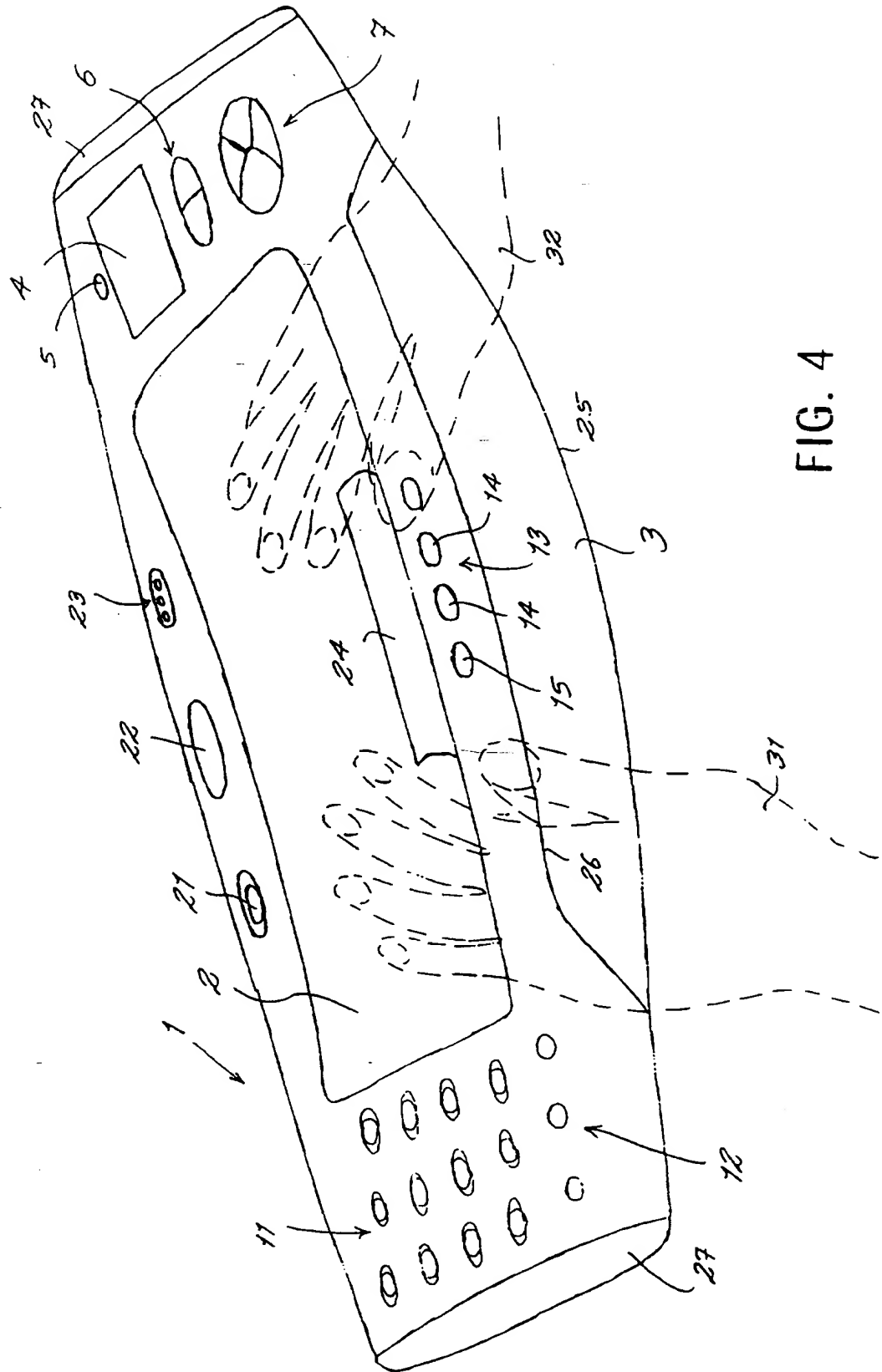


FIG. 4

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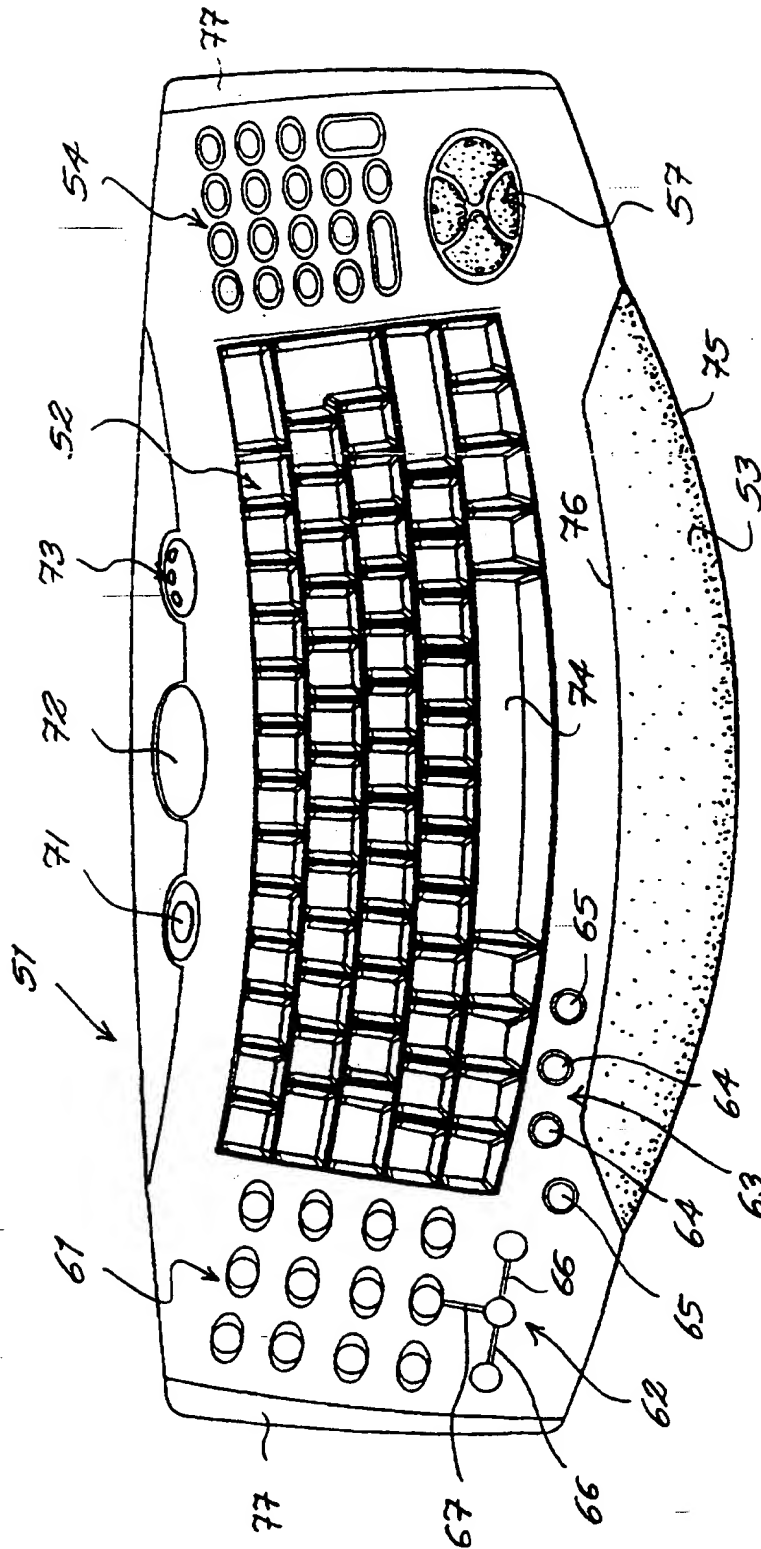


FIG. 5

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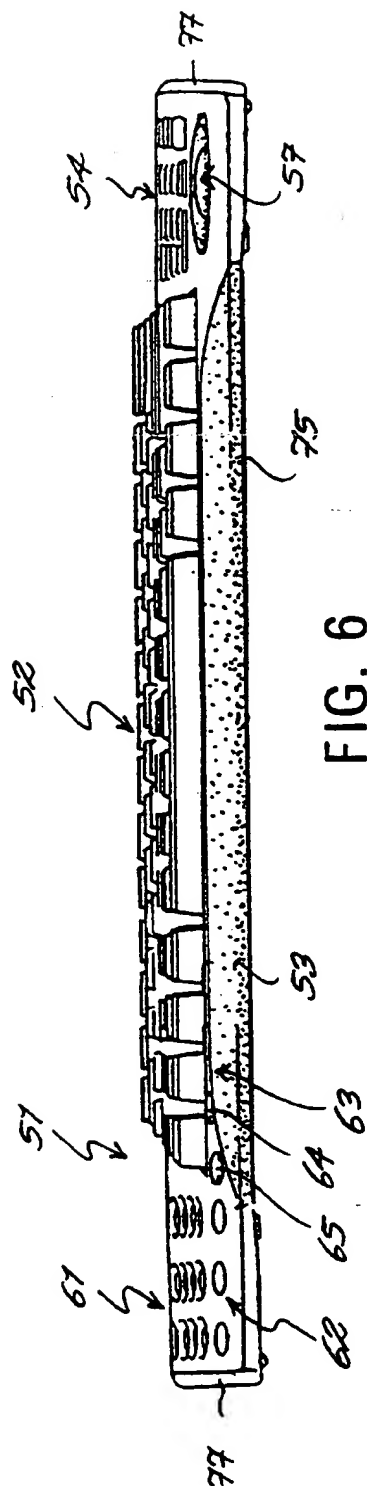


FIG. 6

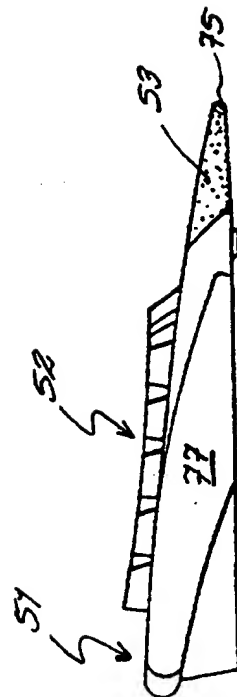


FIG. 7

# INTERNATIONAL SEARCH REPORT

International Application No  
PC1/IE 97/00005

A. CLASSIFICATION OF SUBJECT MATTER  
IPC 6 G06F3/023 G06F3/02

According to International Patent Classification (IPC) or to both national classification and IPC

**B. FIELDS SEARCHED**

Minimum documentation searched (classification system followed by classification symbols)  
IPC 6 G06F B41J

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5 360 280 A (CAMACHO HERMAN ET AL) 1 November 1994 see column 2, line 50 - column 3, line 15; figures 1,3	1-10
Y	---	11-35
Y	US 5 397 189 A (MINOGUE RICHARD F) 14 March 1995 see page 4, line 45 - line 55; figure 9	29-35
Y	---	11-16
A	WO 94 24685 A (KINESIS CORP ;HARGREAVES WILLIAM R (US); LUNDE SHIRLEY A (US)) 27 October 1994 see page 4, line 41 - page 5, line 11; figures 1,2,10	19-28
A	see page 9, line 30 - line 36 see page 5, line 12 - line 20 ---	32
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☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

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Date of the actual completion of the international search

16 May 1997

Date of mailing of the international search report

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# INTERNATIONAL SEARCH REPORT

International Application No.  
PCT/IE 97/00005

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT		
Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	WO 94 27274 A (GRANT ALAN H) 24 November 1994 see page 14, line 30 - page 15, line 14; figures 1,13,14 ---	17-28
A	US 4 324 976 A (LAPEYRE JAMES M) 13 April 1982 see the whole document ---	24
A	PATENT ABSTRACTS OF JAPAN vol. 017, no. 419 (P-1585), 4 August 1993 & JP 05 080925 A (HITACHI LTD), 2 April 1993, see abstract -----	33,34

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